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SIGNET

31 May 1963

MENDIANNEL FOR: Assistant for Plans and Development

THROUGH:

Executive Secretary, TIC

MUTCT

Staff Staff -

Proposal for

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Development of a Prototype Coherent Light Enlarger and Spatial Filter

MITALICE:

(a)

of 24 April 1963.

entitled "Proposal for Prototype Coherent Light

Enlarger and Spatial Filter."

L. MODIAN:

To develop an image modulation transfer system by which the photo interpreter can fully exploit intelligence information contained in original low contrast imagery recorded at frequencies as high as 200 cyc/mm.

2. PACTA;

Aerial chotographic acquisition equipment, techniques and materials are now capable of producing original negatives containing intelligence information at spatial frequencies up to 200 cyc/ms. Due to physical image attenuations introduced by the atmosphere, vibrations and other elements of the shotographic system, such high resolution imagery is invariably of low amplitude modulation (contrast). This order of resolution at lew contrast exceeds the adulation transfer capability of all current systems and can be read-out only by use of a high performance laboratory microscope. Prequent substitution of the laboratory microscope for compaly used low-power magnifiers and viewers for large volume interpretation is not practical. This is due primarily to the miniscale field of view, for a suitable objective. Such a narrow field would limit the interpreters view of the subject and very seriously retard the process of image analysis at a time when the need for accoleration of interpretestion procedures has become imperative.

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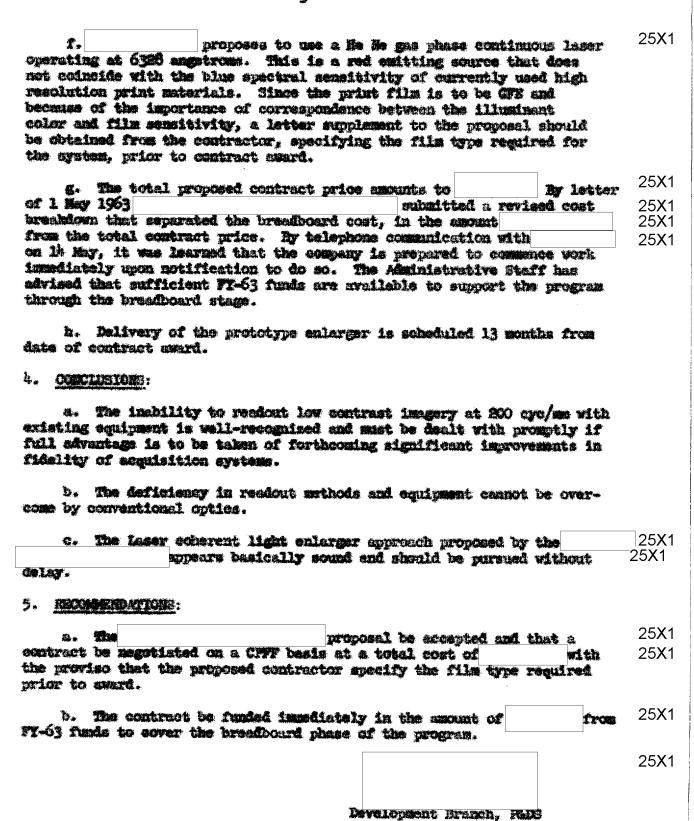
3. MATESION:

- a. If, in a conventional approach to the problem, one were to assume development of the (diffraction-limited) lens to achieve a modulation transfer function of 0.9 at 200 cyc/mm, it could be shown mathematically that the image cone of light must be factor than f/l. To achieve a modulation transfer function of 1.0 at 4% enlargement would require a lens factor than f/0.8. Such a lens would be practically impossible to design as a diffraction-limited system to cover a Tomm square format.
- b. It therefore becomes apparent that the problem cannot be overcome by conventional optics. In recognition of this fact and anticipation of acquisition frequencies far in excess of those previously
 encountered, has submitted the subject
 proposal embodying a new and proprietary concept by which this deficiency
 can be alleviated.

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- c. The proposed method would include development of a fixed 4X coherent light enlarger and spatial filter. The concept of coherent illumination is said to yield benefits in the modulation transfer function achievable with relatively slow lenses. The theoretically achievable modulation transfer function with an f/4 lens at 200 cyc/mm remains at unity out to one-half the limiting frequency for incoherent illumination and then drops to zero. With coherent illumination, an f/4 come of light is therefore expected to yield 100% modulation transfer function at 200 cyc/mm.
- d. In practical application the proposed enlarging system at \$\frac{1}{2}\$ magnification can be expected to produce a transparency in which the modulation spatial frequency has been reduced to one-fourth, while the amplitude modulation remains at unity. Stated in other terms, information contained in the 200 cyc/mm recording in the original transparency is presented at 50 cyc/mm while the amplitude modulation (contract) of the image remains identical to that of the original. Without loss of information the P.I. would then be able to reed out the image fully with conventional viewing instruments.
- has proposed first to produce a breadboard unit end then a deliverable prototype coherent light enlarger. It is intended that the breadboard unit will serve to prove out the principles and provide a base for making final design decisions and measurements. The prototype will then be fabricated on the basis of the findings. All usable parts and components of the breadboard unit will be incorporated in the prototype.

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